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**The impact of hot food takeaways near schools in the UK on childhood obesity: A systematic review of the evidence.**

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## **Abstract**

### **Background**

Obesity is the greatest health issue for this generation; schools have improved food offered within their grounds. The built environment surrounding schools and pupils' journeys home have not received the same level of attention. This review identified papers on impacts of hot food takeaways surrounding schools in the UK.

### **Methods**

Methods were informed by the PRISMA (QUORUM) guidelines for systematic reviews. Searches were completed in 12 databases.

### **Results**

Fourteen papers were included and quality assured before data extraction. Three descriptive themes were found; descriptions of hot food takeaway's geography and impacts concerning schools, strategic food policy, and pupils reported food behaviour.

### **Conclusions**

Most included studies compared anthropometric measures with geographical location of hot food takeaways to find correlations between environment and childhood obesity. There was good evidence of more hot food takeaways in deprived areas and children who spend time in deprived neighbourhoods tend to eat more fast food and have higher BMIs. Few studies were able to quantify the correlation between school's environment and obesity amongst pupils. This lack of evidence is likely a factor of the studies' ability to identify the correlation rather than lack of a correlation between the two variables.

### **Key Words**

**Obesity, Fast Food, Food Environment, Systematic Review**

## Introduction

Obesity is the greatest health issue facing the current generation; type two diabetes and other lifestyle related illnesses continue to rise within the population (1). Since *Jamie's School Dinners* was broadcast on UK television in 2005, drawing attention to the way food was managed in schools, many schools have worked hard to improve the food offer within their grounds and to influence food behaviour positively amongst their pupils.

The built environment surrounding schools have not received the same attention. The term obesogenic was first identified by Boyd Swinburn (2), who defined it as the '*sum of influences that the surroundings, opportunities, or conditions of life have on promoting obesity in individuals or populations*'. Recent guidance from the National Institute for Clinical Excellence (NICE) and Public Health England (PHE) recommend the *use of local planning policy to restrict development of hot food takeaways around schools, leisure centres and other areas where children accumulate* (3, 4). Planning and PH professionals have demanded evidence of what makes a healthy neighbourhood (5-7). A focus has been the restriction of hot food takeaways around schools.

Hot food takeaways are defined under planning guidance as providing hot food to the public without making seating available to customers to eat their meals inside the premises. They can serve any form of hot food but have been shown to serve foods which are high in salt, sugar and saturated fat (8); increased consumption of which is associated with higher risk of obesity and co-morbidities of CVD, diabetes, and osteoarthritis (6). Lake has categorised hot food takeaways as 'Convenience and instant food outlets' providing '*food ordered at till, food predominantly pre-prepared and held at temperature but can be prepared on ordering. Food for takeaway or immediate consumption only*' (9).

As the link between high fat, salt, sugar foods and obesity is more strongly evidenced, calls for controls on these foods have increased (1, 3, 4). Local authorities have begun to introduce policies restricting hot food takeaways, which focus most commonly on the 'school food environment' to enable change in individuals and their environment(10).

One counterargument is hot food takeaways 'could' serve healthy foods. Planning legislation allows any form of hot food to be served by an 'A5 takeaway'. The balance between encouraging or discouraging premises from opening concerns planning officers. For example, The Chartered Institute of Environmental Health's (CIEH) "takeaway toolkit" encouraged local council Environmental Health Practitioners to promote hot food takeaway owners to reduce impact on their customer's health.

The aim of this review was to identify all papers published since the identification of the obesogenic environment in 1998 focused on the impact of hot food takeaways in the food environment surrounding schools in the UK on childhood obesity

## Methods

The methodology of this review was informed by the PRISMA (QUORUM) guidelines for systematic reviews.

### Eligibility criteria

Exclusion and inclusion criteria listed below in table 1 were developed by the three researchers.

### Table 1

### Search strategies

Systematic searches were carried out using the following search terms:

### Table 2:

The interdisciplinary nature of the subject matter required a wide range of databases to be searched: Cochrane Library; NICE guidance, Medline; pubmed; Web of Science; AMED; CINAHL; Embase; psycinfo; SOCINDEX; TRIP (Turning Research into Practice) BMJ. These databases cover medical, educational and social science databases and were likely to find the most relevant papers from each field of study.

Searches were completed in June 2016 using all three search strings simultaneously except on TRIP which prevented combined search strings. Individual search strings were used with hand searching of returned papers.

### Study identification

Search results study titles were screened, irrelevant titles removed, remaining titles were collected and organised using ENDNOTE X4. Duplicates were removed and abstracts were downloaded for investigation. Abstracts not meeting inclusion criteria were removed. Full text copies of eighteen papers were downloaded and reviewed by one researcher (CT); papers not meeting inclusion criteria were excluded at this stage. Fifteen papers were screened independently by two researchers (JR and CP) to confirm inclusion and one paper was excluded using exclusion/inclusion criteria. Quality assurance of included papers was carried out before data extraction. See figure 1 for selection process and results.

## Results

Figure 1:

Included studies

Quality Assessment and data extraction

Three quality assessment processes were used as included studies applied a range of methods. Observational studies were quality assessed using criteria adapted from the CRD handbook (11). Qualitative papers were assessed using criteria adapted from Spencer's framework for Quality in Qualitative Evaluation (12). Systematic reviews were quality assessed using criteria adapted from Greenhalgh's 'Improving the quality of reports of meta-analyses of randomised controlled trials: the QUORUM statement'(13). Results are listed below in table 3

Table 3:

## Study focus

Fourteen papers met the inclusion criteria. Four descriptive categories were expected within the papers, (1) describing fast food impacts in the environment around schools (2) describing policies in food environments surrounding schools, (3) describing food related behaviour by pupils in fast food restaurants in the food environment surrounding schools and (4) evaluation of interventions into the food environment designed to influence one of the three categories above (environment, behaviour and policy). The papers found were categorised into themes as described (Table 4), no papers reporting theme 4 were found and only three categories were used in the table below.

- 1) Problems, effects or impacts of hot food takeaways in the food environment surrounding schools on BMI/Weight/Obesity
- 2) Strategic policy for food environments surrounding schools
- 3) Food related behaviour by pupils or adults in the environment surrounding schools.

Table 4:

## Main findings from the evidence in the included papers

### Theme 1: Problems, effects or impacts of hot food takeaways in the food environment surrounding schools

The definition of hot food takeaway used in all papers was heterogeneous. Edwards, Macdiarmid, Briggs, Lake, Devi and Harrison did not define hot food takeaways although they referred to them within their paper's text (9, 14-17). Harrison, Jones and Griffiths categorised hot food takeaways and corner shops as unhealthy and supermarkets and green grocers as healthy (18, 19). Fraser found children accessing supermarkets to purchase crisps, chocolate and fizzy drinks therefore the categorisation of a supermarket as healthy may mask health impact (20). The Food Standards Agency standardised coding category allows any hot food to be sold; healthy or unhealthy in a hot food takeaway (21).

Caraher, Madelin, Ellaway, Griffiths, Harrison, Jones and Gallo all used food premises registration data held by the local authority to describe the food environment surrounding schools (7, 17-19, 22, 23). Harrison used the yellow pages to confirm the location of hot food takeaways (17). Harrison and Gallo carried out a foot survey recording the location and type of all food businesses within the survey area (17, 23).



Using anthropometric measures Harrison, de Vet, Fraser, Edwards, Griffiths and Macdiarmid categorised children's obesity/overweight status (14, 15, 18-20, 24). Harrison et al used both BMI and FMI to categorise their study participants (17). FMI is a non-standardised way of categorising obesity, it is calculated by dividing fat mass by the height of a person, this is different to BMI where weight is divided by height to categorise. Fat mass is measured by the use of bioelectrical impedance assessment (BIA).

Edwards, Fraser, Griffiths and Macdiarmid used BMI to categorise children in their studies (14, 15, 19, 25). De Vet used weight (24). BMIs were calculated using secondary data from programmes such as the National Child Measurement Programme (NCMP) or its local antecedent.

## Theme 2: Strategic policy for food environments surrounding schools

Fraser and Edwards found children in schools were exposed to more hot food takeaways than expected and suggested this had implications for obesity control policies (25). Ellaway supported this finding; in Glasgow there are on average 35 food outlets within a ten minute walk of each secondary school (22). Harrison found some associations between obesity and the design of home and school environments, with the strongest associations observed amongst the girls in her study (17). Griffiths et al paper found *while consumption of fast food may be associated with obesity...the evidence from their study was not strong enough to say exposure to fast food and other food outlets in the home, school and commuting neighbourhoods increases the risk of obesity in children* (19).

Gallo described the school fringe environment in the UK and found the provision of 'traditional sit down eateries' more common in affluent neighbourhoods, and there were more 'Convenience and Instant food outlets' in deprived areas (23). Harrison et al's second paper included in this review suggested the physical environment of schools has an impact on children's diet and physical activity; however the hot food takeaway element of this study was very small (18).

Caraher identified the need for a comprehensive public health strategy which linked across formal public health services and local authority planning services in order to impact on the foods eaten by children during the whole school day. Caraher also recommended nutrition and education services be involved in any programmes designed to impact on obesity in children (7).

Edwards and Clarke recommended solutions to the currently obesogenic environment around schools be designed specifically for each geographical area, raising issues of the generalisability of their work. They warned what was successful in one food environment may not work in another; they cautioned their work in Leeds was not generalisable unless

local issues are taken into account as well (14).

Devi concluded the impact of treating pupils as 'consumers' of school catering services is they are able to undermine the financial viability of their school's catering service (16). This acts as a lever to force canteens to produce food which is both popular and profitable; in today's society this is likely to be highly processed and unhealthy. Devi also concluded treating pupils as consumers will ultimately undermine any health promoting ethos within the school canteen setting.

Estrade and Dick offered a similar conclusion in their paper focusing on independent food shops in disadvantaged areas of Glasgow. They found business owners faced *significant barriers to offering healthy food choices* including competition and pricing policies within neighbouring businesses (26).

### Theme 3: Food related behaviour by pupils or adults in the environment surrounding schools.

De Vet found easy access to unhealthy food products was associated with higher consumption of unhealthy foods. This was contradicted by the Griffiths review which found no evidence of a link between increased exposure to fast food and increased consumption of fast food (19, 24). De Vet also found this effect was lower amongst children who used *self-regulation strategies to facilitate healthy eating*. Fraser found teenagers who ate at hot food takeaways consumed more unhealthy foods and were more likely to have higher BMI SDS than those teenagers who did not eat frequently at hot food takeaways (25). In contrast, Macdiarmid found the pupils in their survey reported most often purchasing food or drinks at supermarkets (15). They also found less than 10% of the secondary school pupils in their survey purchased high sugar foods, such as non-diet soft drinks and confectionery, every day at lunch time. Macdiarmid identified a need for wider public health strategies to improve the dietary intakes of young people across the whole day, not solely during school hours. This was supported by the work carried out by Briggs which concluded parents were the *key moderators of (children's) food availability and accessibility* (9).

## **Discussion**

### **Main findings**

This review found analysis of interventions that change the food environment around schools is missing from the literature. Most studies included in this review compared anthropometric measures with geographical location of hot food takeaways in order to search for correlations between environmental factors and obesity in children.

Through following a standardised and wide search strategy this review aimed to locate papers focused on the hot food takeaways in the environment around schools in the UK. These areas have become the focus of attention since the first UK local authority used the planning legal process to prevent the development of fast food retail outlets in their borough (27). This review aimed to build on the evidence already published on this topic and provide insight into the potential focus of future studies. The design of the review was intended to provide the widest selection of relevant papers; the papers identified show much is known about the design of the environment surrounding schools, comparisons between deprived areas and less deprived areas were well represented in the papers found. The location of fast food outlets in relation to schools has been repeatedly documented and described.

The literature also indicates the definition of hot food takeaways varies between studies. This makes comparing results difficult and may be obscuring the link between fast food geography and weight status.

BMI was used as the obesity comparator because it is non-invasive, easy and cheap to gather. BMI however has drawbacks when used to categorise children (28). The use of BMI to describe children's health status can be biased, as body composition changes substantially as children age and this is more important in the analysis of BMI in children. BMI takes no account of different body shapes, puberty or ethnicity which all affects the accuracy of a BMI calculation in children (29).

FMI is rarely used in clinical settings so was used only in studies where primary anthropometric data was collected. According to Cole using the percentage of fat body mass to calculate obesity is the ideal weight categorisation tool; however fat mass percentage is impractical to obtain within clinical settings for epidemiological use. Percentage fat mass is measured by passing a low voltage electrical current through the body, electrical resistance is equated to percentage fat. (28).

BMI status is a distal measurement, it does not change quickly, it has been difficult to prove a causal relationship between obesity status in children and adult disease (28, 29). Small changes monitored in a short time period (for example 12 weeks) often do not equate to changes over a long period (for example 12 months). It is therefore difficult to rely on short term changes in BMI as a measure of success of interventions. Proximal measurements such as food behaviour may be more accurate measures of an intervention, however these are difficult, time consuming and expensive to collect. This may explain why so many included studies relied on BMI.

Using geographical data about fast food retail locations to identify saturation of hot food takeaways in a geographical location has limitations. This data is 'point in time'; the local authority holds data on category of food premises at its last inspection but this data could be up to two years old. The accuracy of the geographical information therefore varied between studies.

NCMP data was used by several of the papers as a measure of obesity. There is no guarantee the children measured in the NCMP have been exposed to the geographical area in which they are measured due to children moving house/schools.

### **What is already known on this topic?**

The design and building of the environment within our cities is iterative. Planning policy is difficult to change; years may pass between the first inclination to change a policy and the change. Several more years may then pass before the built environment is significantly impacted by the policy. This makes the study of this impact difficult to analyse and time consuming. This is reminiscent of the study of exposure to cigarette smoke and its impact on health. Tobacco smoking was identified as harmful to health in the 1940s and 1950s. The prevention of exposure to tobacco smoke in the working environment was a hard won change to the built environment and was legally enshrined in the Health Act 2005 (30). Similarly the correlation between fast food retail location, fast food consumption and obesity is still disputed. This lack of evidence may however indicate the inability of many papers to measure the impact of hot food takeaway exposure accurately. Cohort studies such as the Fenland Study, Cambridgeshire (31) and the ALSPC (32) are beginning to identify more substantial evidence for this link.

Despite the lack of good evidence on hot food takeaways and health, planning policies around the UK are being changed to reduce exposure to fast food, a review by Medway Council in 2013 found 21 local authorities in England with a hot food takeaway related policy

in place(10). It is therefore timely to investigate the impact of interventions that change the food environment outside the school grounds.

### **What this study adds.**

In future studies the location of hot food takeaways should be confirmed and the 'healthiness' of foods available should be rated. The assumption all hot food takeaways sell solely unhealthy foods could mask the correlation between unhealthy hot food takeaways and obesity.

Future research should investigate the impact of spatial planning around schools on food behaviour.

A standardised definition of fast food such as Lake's should be used in future studies. This would allow comparisons between data sets.

Analysis of the impact of changes to the food environment around schools should be undertaken. Some data are available from existing cohort studies where food behaviour has been collected over several years along with anthropometric measures.

There is good evidence of higher numbers of hot food takeaways in more deprived neighbourhoods. The literature showed children who live, work and socialise in deprived neighbourhoods tend to eat more fast food and have higher BMIs. Few studies found were able to adequately quantify a correlation between the food environment surrounding schools and obesity amongst pupils attending those schools. The lack of reliable evidence found in this review is more a factor of the ability of the studies found to identify the correlation than the actual lack of a correlation between the two variables.

### **Limitations of this study**

This review was not able to carry out a meta-analysis due to the heterogeneous nature of the papers found. Fast food around schools is a live topic and new research which is relevant may have been published since the database search was completed.

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3000/3000 words

## Key Points

1. The literature provides good evidence there are higher numbers of hot food takeaways in more deprived neighbourhoods.
2. Few studies found were able to adequately quantify a correlation between the food environment surrounding schools and obesity amongst pupils attending those schools
3. The lack of reliable evidence found in this systematic review regarding the impact of hot food takeaways in the food environment around schools on obesity in children attending those schools is more a factor of the ability of the studies found to identify the correlation than the actual lack of a correlation between the two variables.
4. Future research should investigate the impact of spatial planning around schools on food behaviour amongst the population and a standardised definition of fast food such as Lake's should be used in future studies to aid with meta-analysis.

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